

# Applying the Social-Ecological Model to Explore Determinants of Adolescent Nutrition in Mozambique

**Author:** Sarah Bauler, DrPH(c), Health and Nutrition Research Director, World Vision International

**Email:** sarah\_bauler@wvi.org

## INTRODUCTION

Globally, iron deficiency anaemia (IDA) is the leading cause of Disability-Adjusted Life Years (DALYs) lost among adolescent girls and young women aged 10 to 19 years (1). In Mozambique, iron-deficiency anaemia is especially alarming, with **56% of girls aged 15 to 19 years with anaemia** (Hgb < 12.0 g/dl for non-pregnant women and Hgb < 11.0 g/dl for pregnant women) (*Mozambique MOH, 2018*). Iron deficiency is the most common cause of anaemia and nutritional deficiency. It is required for red blood cell synthesis and is essential for immune response, cognitive development, temperature regulation, and work performance (3). Haemoglobin is a major component of red blood cells. If it falls, the oxygen capacity of the blood decreases can lead to fatigue, reduced work capacity and productivity, increased risk for disease and disability, and poor reproductive outcomes (i.e., preterm birth, low birth weight, postpartum haemorrhaging, and fistulas) (3). Thus, IDA (Hgb < 12.0 g/dl for non-pregnant women) is often used as a proxy for the prevalence of anaemia (4).

## WHAT IS THE SOCIAL-ECOLOGICAL MODEL?

The Social-Ecological Model (SEM) is a framework public health practitioners and researchers use to explore factors contributing to a particular health problem (5). The model recognises the interplay of multiple levels of health behaviour, as described below from the Rural Health Information Hub (6):

- **Intrapersonal/individual factors** that influence behaviour, such as knowledge, attitudes, beliefs, and personality
- **Interpersonal factors**, such as interactions with others, can provide social support or create barriers to interpersonal growth that promote healthy behaviour
- **Community factors**, such as formal or informal social norms that exist among individuals, groups, or organisations, can limit or enhance healthy behaviours
- **Institutional and organisational factors**, including the rules, regulations, policies, and informal structures that constrain or promote healthy behaviours
- **Public policy factors**, including national policies and laws that regulate or support health actions and practices for disease prevention

## WHY USE THE SOCIAL-ECOLOGICAL MODEL TO EXPLORE DETERMINANTS OF ADOLESCENT NUTRITION?

Strategies to prevent adolescent anaemia are not simply about eating more iron-rich foods or adherence to Multiple Micronutrient Supplementation (MMS) or Iron Folic Acid Supplementation (IFAS). Rather, prevention and treatment of adolescent anaemia involves addressing drivers and complex behaviours at multiple levels, from an adolescent's knowledge, attitudes, emotions, to power dynamics within households, accessibility to services, enforcement of child marriage laws, and education and health policies. Although many researchers and practitioners would agree that ecological models are more comprehensive and potentially more effective than frameworks that only address one level (7), developing multi-level interventions to address drivers of adolescent anaemia at more than one level can be much more ambitious, expensive, and more difficult to replicate. However, looking for opportunities to embed adolescent nutrition interventions (often at the individual level) within an existing wider programme or project that is addressing the interpersonal, community, institutional, and policy drivers of nutrition could aid in cultivating the enabling environment, thus improving the likelihood for desired individual behaviour change. In the paragraphs below, I detail how each of the levels within the SEM are drivers of adolescent nutrition in Mozambique.

## APPLYING THE SOCIAL-ECOLOGICAL MODEL TO EXPLORE DETERMINANTS OF ADOLESCENT NUTRITION

### Individual Drivers and Determinants of IDA among Adolescent Girls

#### ***Age, Sex, and Menstruation***

In a study analysing the global disease burden in 204 countries and territories from 1990 to 2019, anaemia was highest among females between 15 to 19 years and 95 years and greater (8). While anaemia does affect boys, years lived with a disability is higher among females than males between 10 to 84 years of age (8). Heavy menstrual bleeding can exacerbate IDA and is often an underemphasised problem among adolescent girls (9).

#### ***Poor Dietary Intake and Devaluing of Traditional Foods High in Iron***

In Mozambique, over 30% of families lack a diversified diet, and adolescents from lower socio-economic families consume fewer high-iron foods, such as beans, meats, and eggs (10). The frequent consumption of iron-rich foods, especially animal-based iron-rich foods, such as red meats, liver, eggs, and chicken, is associated with a significantly lower risk for anaemia among adolescent girls (11). However, adolescents from higher-income families living in more urban contexts may substitute food high in iron and other micronutrients for sugary drinks and processed foods low in nutrition. One study measuring biochemical indicators among adolescent girls in Mozambique found that urban diets were associated with lower serum folate concentration, a risk factor for anaemia (12).

A recent UNICEF report also found that 42% of adolescents in low- and middle-income countries (LMICs) consume carbonated soft drinks at least once daily (UNICEF, 2019). In an analysis of fast food consumption in 54 LMICs, including Mozambique, over 55% of adolescents aged 12 to 15 years consumed fast food at least one day a week, and over 10% four to seven times per week (14). In sub-Saharan Africa, income growth combined with urbanisation drives the demand for more processed foods that lack nutritional value (15). Wild foods, such as the kernels found in the baobab fruit in Mozambique, are rich in iron, calcium, magnesium, and zinc (16). As the demand for processed foods increases, adolescents can replace these indigenous, nutritionally-dense foods, like the baobab fruit, with fast and processed foods. Thus, at the individual level, there is a need to promote valuing traditional and rural foods high in iron and folate (12).

### ***Low Educational and Socio-Economic Status***

Adolescents with mothers who have completed high school are less likely to be anaemic than adolescents with mothers with less than three years of formal education (17). While the opportunity to learn is improving in Nampula Province, less than half of children complete primary school, with **more than 50% leaving school before they complete fifth grade** (18). Girls often leave school to help care for younger siblings, sick family members, or because of cultural pressures (19). Gender inequalities further exacerbate poor school attendance, with 39% of girls compared to 52% of boys attending schools (20). School attendance can also be fluid, with girls dropping out and re-enrolling.

In Nampula Province, access to schools, especially secondary schools, varies greatly depending on if a child resides in a rural or urban context, if a child is a girl or boy, and on socio-economic status (20). Only 8% of children of secondary school age attend secondary school (20), and most secondary schools in Nampula Province are located in urban and peri-urban areas. Thus, disadvantaged girls living in rural areas have significantly poorer opportunities to learn and become literate, including health and nutrition literacy.

### **Interpersonal (Household) Drivers and Determinants of IDA among Adolescent Girls**

#### ***Inequitable Household Food Allocation***

Anaemia is significantly associated with higher food insecurity (21), and women and girls are disproportionately affected by food insecurity (22). Inequitable inter-household food allocation (both quantity and quality) often favours men and boys (23). Although there is a gap in research around gender bias and food insecurity among adolescent girls living in Mozambique, a study in Ethiopia found that adolescent girls are more likely to report being food insecure than boys living in the same household (24). Mozambique also has one of the highest gender inequality indexes (GII) in the world (25). Men in Mozambique also overwhelmingly hold the decision-making power related to selling crops and purchasing food items (26). Thus, I hypothesise that adolescent girls living in Nampula Province may face inequitable intra-household food allocation, similar to other sub-Saharan African countries.

### Poor Access to Clean Water and Sanitation at the Household Level

In a study analysing 47 demographic and health surveys, 60% of women exposed to open sanitation at the household-level had significantly higher odds of being anaemic (27). The prevalence of adolescent anaemia is higher among girls residing in mud homes without improved latrines and in areas with an open sewerage system (28). Poor sanitation and exposure to animal and human faeces can increase the risk of hookworm infection (29) and cause blood loss to the intestines, contributing to iron-deficiency anaemia (30). One water, sanitation, and hygiene (WASH) programme component integrated with a micronutrient intervention found that the use of improved latrines significantly decreased anaemia in the programme districts (OR: 0.67, 95% CI 0.57 to 0.80; CAGR = -4.7%) (31).

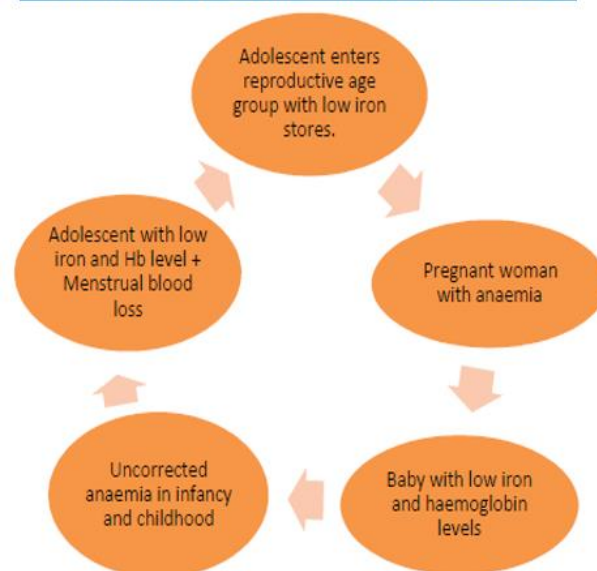
### Community and Social Drivers and Determinants

#### Early Child Marriage

Harmful cultural practices and social norms at the community level are also drivers of IDA among adolescent girls and their children. In Mozambique, the prevalence of child marriage—girls who marry before 18 years—is 48% (32) and the sixth highest in the world (33). The age of first birth in Mozambique is 18.9 years, one of the lowest in the world (34). When undernourished girls marry and give birth early, the intergenerational cycle of anaemia continues, as shown in Figure A. Maternal undernutrition is a known determinant of poor neonatal health outcomes, with undernourished mothers more likely to give birth to low birth weight babies (35). New evidence published in the Lancet shows that stunting and wasting may already be present at birth, and both peak in the first six months of life (36). Improving the nutritional status of adolescent girls can significantly improve newborns' nutritional status and break the intergenerational cycle of anaemia.

**Figure A: Intergenerational Cycle of Anemia**

[JBAR WIFS Weekly Iron and Folic Acid Supplementation Programme \(teachersbadi.in\)](https://www.teachersbadi.in)



### Institutional Drivers and Determinants

#### Poor Access to Nutrition Education and Counselling Services

In Mozambique, there is a gap in the Ministry of Health's unit for adolescents (SAAJ) services' ability to reach adolescent girls with nutrition interventions, especially in delivering micronutrient supplementation and nutrition education to girls within and outside of schools (37). Although there is a national nutrition curriculum, it is delivered to children at primary schools (37); thus,

girls in secondary schools and outside of school do not receive this service (curriculum).

Furthermore, a mixed-methods study of Ministry of Health adolescent nutrition services in Manica Province, Mozambique, found a need to define female adolescents as a separate target group from adult women (37).

## National Policy Drivers and Determinants of IDA among Adolescent Girls

### **Poor Adoption of Multiple Micronutrient Supplementation into Ministry of Health Policy**

Historically, the Ministry of Health in Mozambique has used iron-folic acid supplementation (IFAS) to decrease anaemia among pregnant and lactating women and menstruating women and girls (38). However, emerging evidence shows that multiple micronutrient supplementation (MMS) is a superior product to IFAS in reducing anaemia among adolescents. A two-stage meta-analysis of 17 randomised controlled trials of LMICs, which compared MMS to IFA alone, found that MMS resulted in greater reductions in risk among pregnant women for low birth weight (-19%), small-for-gestational-age births (-8%) and infant mortality at six months of age (-29%) (39). If Mozambique transitioned from IFAS to MMS, an estimated 384,443 DALYs would

In Mozambique, transitioning from IFAS to MMS is expected to....

Avert	<b>384,443</b>	DALYs*
Prevent the deaths of an additional	<b>5,002</b>	children
Yield benefits that are	<b>144</b>	times greater than the costs
Be considered	<b>very cost effective</b>	according to the WHO guidelines (7)

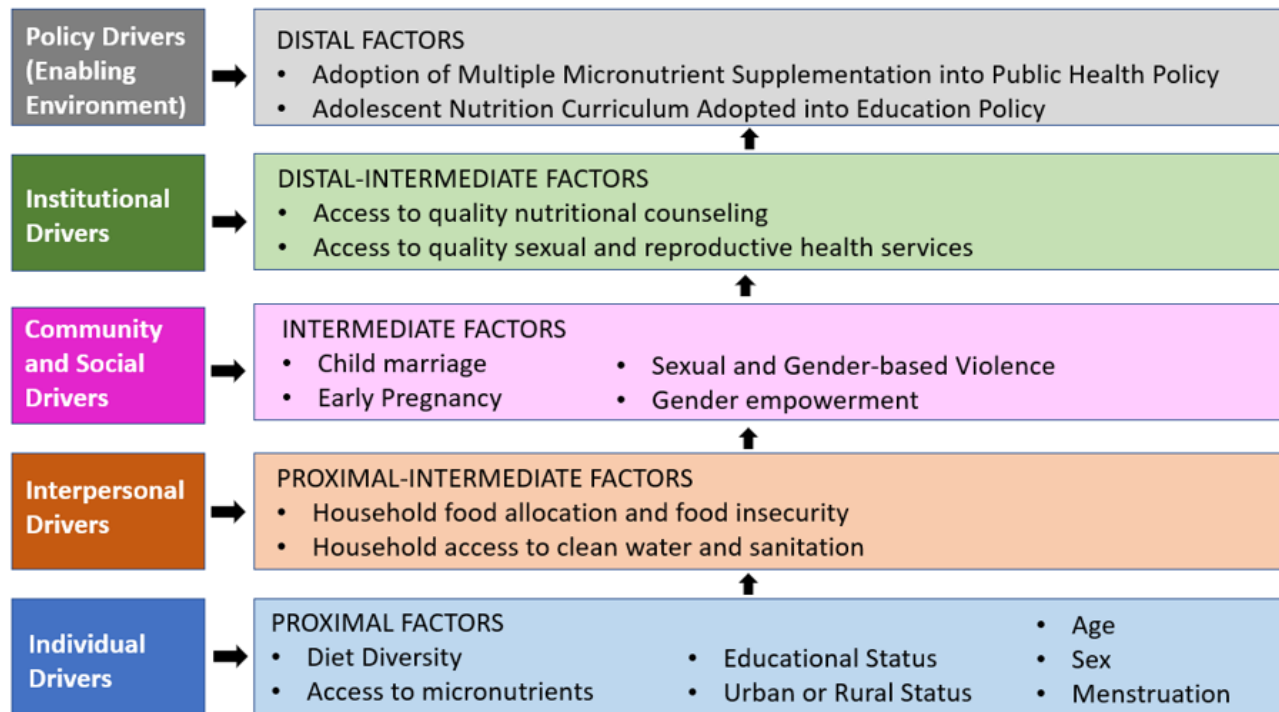
\* DALYs averted over a 10 year period

be averted, and it would be considered very cost-effective according to WHO guidelines (40). In 2021, the World Health Organization added MMS to its [list of essential medicines](#) (*WHO-MHP-HPS-EML-2021.02-Eng.Pdf*, 2021); thus, a window of opportunity exists to develop contextualised delivery models of MMS, along with promotion of desired adolescent nutrition behaviours, to decrease anaemia among adolescent girls.

## CONCEPTUAL FRAMEWORK

In light of this analysis, I have developed a conceptual framework (Figure B) to aid in the design of programmes and interventions seeking to improve nutritional outcomes among adolescent girls. While the framework is specific for Mozambique, it may be transferable to other contexts, especially contexts with similarities to Mozambique.

**Figure B: Drivers and Determinants of Iron-deficiency Anaemia among Adolescent Girls in Mozambique: A Conceptual Framework**



## CONCLUSION

The prevention and treatment of adolescent anaemia involves addressing drivers and complex behaviours at multiple levels, from an adolescent’s knowledge, attitudes, and emotions, to power dynamics within households, accessibility to services, enforcement of child marriage laws, and education and health policies. Applying the SEM as a theoretical perspective and programmatic framework can help researchers and practitioners better understand multiple drivers at the proximal, intermediate, and distal levels. Thus, increased collaboration and coordination is needed as we harness our collective strengths and resources to address drivers of adolescent nutrition at each level within the SEM.

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